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December 22, 1992

Mr. Tom Beckman
EG&G Rocky Flats Project
Building 080
P.O. Box 464
Golden, CO 80402-0464

Subject: Rocky Flats Plant Solar Evaporation Ponds Stabilization Project
[WBS 231 TREATABILITY STUDY - HALLIBURTON NUS ROCKY FLATS]
Freeze/Thaw Temperature Study
RF-HED-92-0886

Dear Mr. Beckman:

Enclosed is a draft plan for implementing a freeze/thaw study on-site at Rocky Flats. The purpose is to:

1) Evaluate applicability of results for pondcrete, saltcrete, pondsludge and clarifier materials with test results.
2) Evaluate the freeze/thaw characteristics of halfcrates in both a heated and unheated environment.
3) Predict number of annual freezing cycles over the last 10 year period at Rocky Flats.

The study can be used to expel concerns related to temperature impacts on the stability of newly stabilized and remixed material. Modification #11 requires HNUS to submit a proposal for long term durability tests. These tests are required to allow HNUS to be responsive to the long term treatability study proposal required in modification #11.

HNUS considered using the existing triwalls for the plan. The triwalls were eliminated as a viable option due to:

1) Waste solids within triwalls is lower than proposed HNUS halfcrates. From characterization data, 20-70% of existing pondcrete triwalls are water.
2) The size and configuration of triwalls is dramatically different than the proposed halfcrates.

Estimates have not been finalized for this plan. Since a cost proposal is due by January 15, 1992, the estimate will be included within the proposal. The costs will be segregated for ease in identifying applicable costs to this study.

We request EG&G provide a technical review by December 23 for inclusion of any specific requirements or comments within the cost proposal.

If you have any questions please contact Jack Templeton at the Broomfield Office.

Sincerely,

HALLIBURTON NUS ENVIRONMENTAL CORPORATION

Jack Templeton for Ted Bittner

Ted A. Bittner
Project Manager

TAB:tw
Enclosure

cc: S. Heiman

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FREEZE/THAW TEMPERATURE STUDY
DETERMINATION OF CYCLES IN SURROGATE WASTE
ORDER OF MAGNITUDE ESTIMATE

I. OBJECTIVE

To determine the required durability of stabilized waste during the freeze/thaw cycles occurring at unheated covered locations at Rocky flats. This is necessary as the stabilized waste might have to survive several winters on site prior to shipment to Nevada. The required durability will be determined using measured data obtained on surrogate halfcrates and an unsteady state heat transfer model.

The study includes using a brine solution as a surrogate for the C Pond/Clarifier and Saltcrete materials, and water and bentonite as a surrogate for the A/B Pond and Pondcrete materials.

II BACKGROUND

There is presently a belief that the Pondcrete and Saltcrete billets presently stored on the Rocky Flats' 750 and 904 pads were successfully stabilized, and have degraded to their present state due to freezing and thawing or humidity changes. This would suggest

- that no further stabilization should be performed until the stabilized waste can be accepted at its final storage location, and
- that freeze/thaw cycling at its ultimate storage location should be avoided.

The HNUS Treatability testing has shown that the proposed stabilized waste mix formulation will produce a product that will withstand a minimum of 12 freeze/thaw and wet/dry cycles.

III METHOD

EG&G certified halfcrates, complete with cardboard liner, plastic liner and plastic bladder will be filled with stabilized surrogate wastes similar to the proposed Pondsludge and reprocessed Pondcrete/Saltcrete. Each halfcrate will weigh up to 4700 pounds with a configuration of 2x4x7. Currently triwalls are excluded from the study.

We will produce 28 halfcrates of stabilized C Pond/Clarifier and Saltcrete surrogate waste (hereafter referred to C Pond), with each containing 0 to 4 thermocouples depending on its intended use, and 1 halfcrate of stabilized Pondcrete and A/B Pond surrogate waste (hereafter referred to as Pondcrete), containing 3 thermocouples. Three concurrent tests are proposed.

The first test involves a single C Pond halfcrate containing four thermocouples which will be placed in carefully selected locations in the block. Monitoring the temperature change in this block will yield the heat flux through the stabilized C Pond waste matrix, which will used for the initial set points and boundary conditions for the mathematical model.

The second test will be identical to the first test, but using the Pondcrete surrogate waste, and will be used to modify the C Pond mathematical model for A/B Pond and Pondcrete waste, if necessary.

Concurrently, the third test involves monitoring the temperature change of several C Pond halfcrates in a 27 block stack. This will provide the data which will allow us to tune the single block models to duplicate a stack of halfcrates stored in an unheated tent.

If the study is to performed at the 904 pad at Rocky Flats, EG&G must be able to accept the shipment of stabilized surrogate waste onsite. If this is possible, the halfcrates will be shipped to a heated tent at the 904 pad. If this is not possible, a suitable location off site will have to be chosen. Once the halfcrates have reached an inside temperature matching the heated tent ambient temperature, they will be moved into an unheated tent where the single blocks will stand alone and the 27 blocks will be stacked in a 3 by 3 by 3 halfcrate high configuration.

All of the thermocouples will be connected to a data logger, or a laptop PC (already procured for use in the C pond conveyor control system) through a logic board. This will minimize manpower and cost while collecting and compiling the data.

As the internal temperature of the halfcrates decreases towards the ambient air temperature of the tent during the winter months, the internal block temperatures of the single halfcrate and the stacked halfcrates and the ambient air temperature will be monitored. Once the cooling portion of the freeze/thaw cycle is complete, all 29 halfcrates will be moved into one of the heated tents, placed in the same configuration, and the temperature rise for thawing will be documented. Though heat flux is numerically the same for heating and cooling, this will directly validate the thaw portion of the model. After the halfcrates warm back up to the heated tent ambient temperature, they will be moved back out to the unheated tent to produce more freeze data.

This initial data for the single C Pond halfcrate will be sent to Brown and Root Houston where it will be used to generate an unsteady state heat transfer model for a single halfcrate. By assuming an air space between the halfcrates, the model will then be expanded to include a stack of halfcrates. The data generated from monitoring the Pondcrete halfcrate will be used to modify the model, if necessary, for a stack of A/B Pondsludge and Pondcrete halfcrates. The data generated from monitoring the stack of halfcrates is absolutely necessary as once the model is produced the actual data will validate the accuracy of the model and can also be used to tune the model to very accurately represent the unsteady state heat transfer in a stack of halfcrates.

Once the model is generated and validated, the actual ambient air data collected at Rocky Flats for the last 5 to 10 winters will be entered into the model which will calculate the number of freeze/thaw cycles. Not only will the completed mathematical model determine the annual number of freeze/thaw cycles at the Rocky Flats Plant Site, but with actual

temperature data for the ultimate storage location, the model will predict the number of freeze/thaw cycles under final storage conditions.

IV COST ESTIMATE

A. Production of Surrogate Halfcrates

There are four options for producing the surrogate pondcrete halfcrates for the Freeze/thaw Temperature study.

1. Ship the surrogate half crates that were produced in Duncan Ok. during the surrogate testing performed in early June of 1992 to Rocky Flats site and perform the temperature profile studies using the thermocouple already existing in the half crates and inserting additional ones as needed.

   Problems:
   - some of the half crates have been stored outside and degraded due to the weather,
   - some of the half crates were cored extensively and would not provide accurate data,
   - there are not enough suitable half crates to perform the study as required, and
   - some of the halfcrates were not made to EG&G specifications, and would not provide accurate data. This included varying the size of the package and compartments within the package.

   This option was excluded based on the number of halfcrates being inadequate and the extensive coring.

2. Mobilize standard cement mixing equipment to Rocky Flats Plant Site, Golden, Colorado, and blend C Pond brine and pozzolan blend to produce approximately 30 half crates. Move these half crates to the 904 Pad for temperature profile study.

   Problems:
   - site specific procedures for handling actual waste will have to be followed,
   - containments will have to be constructed in which to place the equipment,
   - site approved operating instructions will have to be generated,
   - a much longer time frame must be expected to even begin the test,

Though this would use actual waste and produce actual stabilized product, this option was excluded based on all of the above problems.

3. Mobilize standard cement mixing equipment to Colorado, possibly Brighton, and blend surrogate brine and pozzolan blend to produce approximately 30 half crates. Deliver these half crates to Rocky flats site for temperature profile study.

   Problems:
   - a surrogate brine will not completely model the actual material, and
   - EG&G will have to accept responsibility for proper disposal of all mixing products, including the wash down water.

ESTIMATED COST FOR STEP A - OPTION 3 . . . . . TBD

4. Mobilize standard cement mixing equipment in Duncan, Oklahoma, and blend surrogate brine and pozzolan blend to produce approximately 30 half crates. Deliver these half crates to Rocky flats site for temperature profile study.

   Problem:
   - a surrogate brine will not completely model the actual material.
   - EG&G will have to accept responsibility for proper disposal of all mixing products, including the wash down water.

ESTIMATED COST FOR STEP A - OPTION 4 . . . . . TBD

REQUIRED EQUIPMENT:

1 RCM (cement mixer)
2 densometers
1 100 bbl batch mixer (Brine mixer)
1 180 cfm air compressor (agitator)
2 4000 gallon transports
1 Portable blending scale system
2 660 cu ft storage trailers
1 trailer (half crate delivery)
1 fork lift (half crate movement)
6 tractors
2 pickups

MATERIALS:

Type V Cement	- 26,300 lb.	(279 cu ft)
Flyash	- 52,500 lb.	(710 cu ft)
Lime	- 1970 #	(63.54 cu ft)
Plasticizer	- 0.1 lb./100 lb. pozzolan	
Brine solution	- 6,000 gal	

Water supply - 12,000 gal
40 halfcrates (for test & washup, complete with plastic and cardboard liners)
40 bladders
25 thermocouple (each with 25 feet of cable)

PERSONNEL:

1 Test Supervisor
1 Test Foreman
1 RCM Operator
1 Batch Mixer Operator
1 660 Operator
1 Scale Tank Operator
1 Transport Operator
1 Data Acquisition Operator
2 Halfcrate Operators
1 Fork Lift Operator
11 TOTAL

SCHEDULE:

Notification	- 2 weeks
Mobilization	- 3 days
Setup	- 3 days
Produce Crates	- 1 day
Demobilization	- 3 days

B. Temperature Monitoring of Halfcrates

The temperature profiles of the halfcrates will be monitored using a laptop PC. Data will be taken from the time the blocks arrive at site to the middle of April. The PC will be maintained in a lock-box, and should require attention only once daily to collect the previous days data.

EQUIPMENT REQUIRED:

Laptop PC (already procured for the project) . . . . . .
Logic Board . . . . . .
Data Logger (alternative to PC) . . . . . .
Lock-box . . . . . .
Ambient Air Thermocouple . . . . . .

ESTIMATED COST FOR STEP B . . . . . TBD

C. Generation of Heat Transfer Model
We estimate TBD weeks to complete at a cost of . . . . . TBD
(includes program proofing and validation)

D. Determination of Freeze/Thaw Cycles at Rocky Flats Site

The daily high/low data collected by Rocky Flats meteorological department will be input to the model, to determine the number of number of freeze/thaw cycles for the last 10 years.

We estimate TBD weeks to complete at a cost of . . . . . TBD